Climate models of the end-Permian – challenges and perspectives

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The end-Permian is characterized by a carbon cycle perturbation, an associated global warming (5-8 °C), and the biggest known mass extinction. Degassing of thermogenic CH_4 and CO_2 from the East Siberian basins and the Siberian Traps lavas are among the hypotheses to explain both the warming and the extinction. In order to test the different degassing scenarios, we have used basic equations for the climate perturbation potential of greenhouse-gases as well as a paleoclimate model with appropriate palaeogeography, slab ocean, and sea ice module. Since the challenges involved in palaeoclimate modelling increase with time before present, we have a strong focus on both uncertainty analyses and comparing our results with palaeoenvironmental data. Thus we can test the accuracy of the input data and the predefined boundary conditions in addition to the climate model output data itself. We have used a relatively simple climate model with high computational efficiency enabling testing of many different degassing scenarios, atmospheric composition, and topography. We have modelled the effects of a wide range of atmospheric greenhouse-gas concentrations and how the different regions change with respect to parameters as precipitation and vegetation types. This new way of using multiple setups also requires application of new methods for evaluation of the climate model data, and we compare the results with variables obtained from the geological record in order to test the different hypotheses.